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The Magazine for Aircraft Maintenance Professionals

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clean, treated & ready to go

MRO Data Management:
unleash the power of the Internet of things

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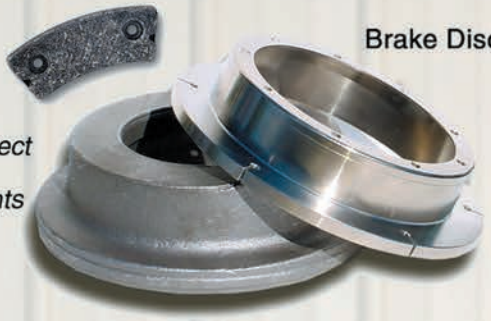

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After the Hype

Of course, the most important aspect of international trade shows is that they shine a spotlight on what's happening in the here and now: new products, services and ideas. But even more exciting is that they can be windows into the future, as manufacturers and engineers share their concepts and prototypes. That was the case in mid-June when Airbus Helicopters lifted the cover off its concept next-generation heavy-lift X6 at the Paris Air Show, a rotorcraft that will initially target oil and gas missions and will reportedly also be suited for search and rescue, and other civilian applications.

"X6 will be for the heavy segment in the next decade what the H160 is today for the mediums," said Guillaume Faury, the President & CEO of Airbus Helicopters. The twin-engine rotorcraft is promised to be "mature" and all-weather ready—including full de-icing—from the first delivery, and boasting a fly-by-wire flight control system.

As the latest program from Airbus Helicopters, the X6 will share common features with the company's latest rotorcraft—including the new H175 and H160. Once adequate program maturity has been achieved in the concept phase, a subsequent development phase will follow, leading to an X6 entry into service anticipated in the 2020s.

As always, time will tell if the reality of the production model lives up to the hype and optimism of the prototype.

— John Campbell
Editor

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Upcoming Events

Not a Bright Idea

The National Airlines Council of Canada (NACC), the industry trade association representing Canada's largest passenger air carriers, recently welcomed the Government of Canada's launch of Not A Bright Idea, a new public education campaign aimed at raising awareness of the dangerous practice of pointing lasers at aircraft.

"We are seeing a troubling increase in the number of laser strikes, and this raises serious safety implications for pilots, passengers and people on the ground," said Marc-André O'Rourke, Executive Director of the NACC. "We hope that by raising awareness of the issue through the Not A Bright Idea campaign, people will think twice before shining a laser at an aircraft."

While pointing a laser into the cockpit is an offence under the Aeronautics Act, the NACC and the aviation community encourage the federal government to take additional action by making the stunt a criminal offence with stronger penalties and by limiting the availability of more powerful lasers. Visit www.tc.gc.ca/NotaBrightIdea to learn more about the dangers of pointing a laser at an aircraft and how incidents can be reported.

CANADA

Abbotsford Air Show
August 7 – 9, 2015
Abbotsford, British Columbia
www.abbotsfordairshow.com

Viking All Operators Forum
September 8 – 10, 2015
Victoria, British Columbia
www.vikingair.com

ATAC National Aviation Conference and Tradeshow
November 2 – 4, 2015
Montreal, Quebec
www.atac.ca

HAC Annual Conference and Trade Show
November 13 – 15, 2015
Vancouver, BC. www.h-a-c.ca

UNITED STATES

Wings over Waukegan
September 12 – 13, 2015
Waukegan, Illinois
www.waukeganairshow.com

California Capital Air Show
October 3 – 4, 2015
Sacramento, California
www.californiacapitalairshow.com

Flying Aviation Expo
October 15 – 17, 2015
Palm Springs, California
www.aviation-xpo.com

Wings over Houston
October 17 – 18, 2015
Houston, Texas
www.wingsoverhouston.com

NBAA 2015
November 17 – 19, 2015
Las Vegas, Nevada; www.nbaa.org

INTERNATIONAL EVENTS

Helitech International
October 6 – 8, 2015
London, UK
www.helitechevents.com

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STCs & new products

Wash Wax Mop cuts cleaning effort

Aero Cosmetics' Wash Wax Mop is said to eliminate the need for ladders while significantly decreasing the time and effort required to clean and wax aircraft. The Wash Wax Mop adds to the Wash Wax waterless wash system with three parts: an extendable handle or pole, dual receptacle mop head, and two replaceable chenille microfibre mop pads. The mop pole comes standard with a reach of four to eight feet. The twin wrap-around pads each perform a specific task: one is for the wet step and one is for the dry step. **For more information visit** www.washwax.com

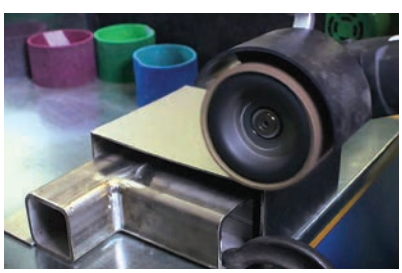
Modular parts washers with features

Oil Eater Flex Line parts washers are ready-to-use units with three tiers of features. These water-based systems have a modular design, interchangeable features and add-on options. Each includes six gallons of eco-friendly Oil Eater original cleaner/degreaser. The basic unit has a 440-lb. working tray, flow-through brush with adjustable fluid control, adjustable gooseneck spigot, skimmer pads, stainless steel drain screen, 26-gallon soaking capacity and thermally protected 350-gph pump. The premium model has all of the basic model's features plus a preset fluid heater, low-fluid-level-protection switch and secondary 50-micron fluid filtration. **For information visit** www.oileater.com

New Snap-on Industrial catalogue

Snap-On's new 800-page 2015 Industrial catalogue includes performance and specifications on all Snap-on Industrial tools and equipment for its major product categories including: tool control, aviation tools, power tools, specialty tools, and safety tools, tools storage, fleet maintenance, and hand tools. Other features of the new 2015 Snap-on Industrial catalogue include information on more than 25,000 products, 30 easy-to-access sections, colour-coded by product category, and large colour photos of thousands of tools with information on product code, sizes, descriptions etc. There are charts and information on torque, and an alphabetical index. **For information visit** www.snapon.com

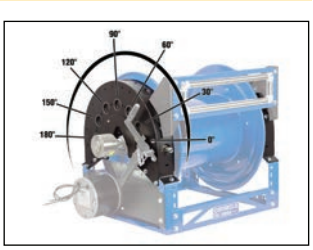
Norton Vortex belts cut faster and longer



Norton Vortex rapid prep belts feature an agglomerate grain said to increase belt life up to three times that of aluminum oxide grain and reduce two to five grit sequences in blending operations. The Vortex agglomerated aluminum oxide grain is claimed to deliver a 10 percent faster cut rate on aluminum, and 20 percent faster cut rate on titanium and stainless steel, with 50 percent or more improved process time by reducing multiple grinding steps. The combination of coarser and finer grit provides up to two times the life on all substrates.

For more information visit www.nortonindustrial.com

Symmetric reel with various payout angles



Coxreels' 1600 Series is said to be the most versatile symmetric reel design in the industry. This reel has an array of components and configurations including the universal bracket kit, which is made from 12-gauge, powder-coated steel, functions as a chain/gear guard and allows for four versatile payout degrees (zero, 30, 60, and 90) for mounting rewind crank, three- or four-way roller guide, and a three-way pin. The universal bracket also includes a removable centre guard cap for easy bearing access. The universal bracket is intended for virtually all equipment areas and applications. **For more information visit** www.coxreels.com

Shining light in tight, dark places

Pelican ProGear's 2780 LED headlight is equipped with a super-bright LED that is said to shine clean, brilliant light of different intensities (53 lumens in low mode, 203 lumens in medium mode, 430 lumens in high mode). It also offers a safety flashing mode, and a downcast mode that makes it optimal for close quarter applications such as engine compartments. It is constructed of water/weather resistant polymer and pivots 70 degrees to direct light where it's needed. Weighing less than nine ounces it comes with a cloth strap and a battery level indicator. **For more information visit** www.pelican.com

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WARRANTY FOR BELL 407 MAIN ROTOR HUB PARTS

LORD Corporation has extended the warranty on all the Bell 407 main rotor hub elastomeric components to 2,500 hours or three years (whichever comes first). The warranty has been extended to align with Bell's mandatory hub overhaul that occurs at 2,500 hours. Parts covered by the extended warranty include the lead lag and shear bearings and damper. Bell approved the upgrade to LORD SPE IIA elastomer on the lead lag and shear bearings in 2014. SPE IIA is LORD Corporation's newest generation of elastomer that was specifically formulated for helicopter bearing applications. Comparative endurance tests validate a significant increase in test life for the SPE IIA bearings—LORD predicts a minimum of 30 percent increase in actual service life.

FIRST FLIGHT OF THE 525 RELENTLESS A SUCCESS

In early July, Bell Helicopter announced the successful first flight of its 525 Relentless super-medium helicopter, which took place at the company's aircraft assembly centre in Amarillo, Texas. "The Bell 525 was announced at Heli-Expo in 2012, and we are proud to have achieved this milestone," said Matt Hasik, executive vice president of commercial programs at Bell Helicopter. One of the defining characteristics of the Bell 525 is its claimed ability to perform CAT-A takeoffs and landings to and from a helipad at maximum gross weight. Even in the event that one of the two engines fails, the Bell 525 provides sufficient power to maintain occupant safety while lifting off with a single operational engine. Bell's test pilots reported that the first flight test included low speed handling qualities with winds gusting to 20 knots.

WORLD'S OLDEST PILOT IS NOW IN THE RECORD BOOK

George Neal, a career de Havilland Aircraft of Canada test pilot and amateur aircraft builder, entered the Guinness Book of World Records as the oldest active, licensed pilot on earth, at 96 years, following his qualifying flight in early June. Joining de Havilland on a permanent basis in 1947, Neal participated in the certification of many aircraft types, including commanding the first flights of the DHC-3 Otter, CS2F 'Tracker', DHC-4 Caribou, as well as being a member of test pilot team on DHC–1 Chipmunk, DHC-2 Beaver, DHC-6 Twin Otter, DHC-5 Buffalo, DASH 7 and DASH 8. In total, Neal has logged more than 15,000 hours on 150 aircraft types.

The veteran pilot flies his own Chipmunk (CF-JAG) from Brampton airport on the outskirts of Toronto and has logged 250 hours aloft in it since 1992. This Chipmunk was initially part of the RCAF training fleet. Designed and built in Canada, 1,283 were built between 1946 and 1956. Following Neal's record-setting flight from Brampton to Pearson International Airport, where the Chipmunk was put on display for the 2015 Induction Gala of Canada's Aviation Hall of Fame, the Guinness record application was put forth by Tom Appleton, chairman of the Hall of Fame. "George's experience is unparalleled in the world of aviation, I believe, holding a Canadian pilot's licence from 1936 until now."

Among his life accomplishments, Neal built a First World War Sopwith Pup fighter aircraft from original plans and drawings, and flew it to Rockcliffe Airport (CYRO) in Ottawa, home of the Canada Aviation & Space Museum where he was chief test pilot for many years. He also restored a Second War Hawker Hind biplane fighter; both aircraft are now part of the museum's permanent collection. He was inducted into Canada's Aviation Hall of Fame in 1995.

LOCKHEED MARTIN LAUNCHES GLOBAL HYBRID AIRSHIP

Hybrid Enterprises announced it is now taking orders as the exclusive, authorized reseller of Lockheed Martin's Hybrid Airships with deliveries planned as early as 2018. Hybrid Airships are said to enable affordable and safe delivery of heavy cargo and personnel to virtually anywhere—water or land, in normal flying weather conditions—with little to no infrastructure. "Lockheed Martin's Hybrid Airships will significantly reduce the cost and environmental impact of remote operations, making it possible to reach locations previously thought inaccessible," said Rob Binns, chief executive officer of Hybrid Enterprises. The technologies required for Hybrid Airships

are already mature and have been demonstrated in-flight by Lockheed Martin's P-791, a fully functional, manned flight demonstrator.

"We've invested more than 20 years to develop the technology, prove the performance, and ensure there are compelling economics for the Hybrid Airship," said Orlando Carvalho, executive vice president of Lockheed Martin Aeronautics. "We have completed all required FAA certification planning steps for a new class of aircraft and are ready to begin construction of the first commercial model and the completion of the FAA Type certification process."

Work is currently underway on the 20-ton variant at the Lockheed Martin Aeronautics facility in Palmdale, California.

SCHWEISS DOORS CHOSEN FOR CAPE CANAVERAL

SpaceX is getting to be a name as identifiable as NASA. Ever since government funding was cut for NASA, SpaceX has been at the forefront of space exploration. The Hawthorne, California-based aerospace manufacturer and space transport services company has already developed expendable rockets able to deliver cargo to the International Space Station (ISS) and has targeted satellite launch services, passenger tourist flights and cargo delivery for its corporate future. "SpaceX is like Special Forces—we do the missions that others think are impossible," said SpaceX CEO and chief designer Elon Musk. "We have goals that are absurdly ambitious by any reasonable standard, but we're going to make them happen. We have the potential here at SpaceX to have an incredible effect on the future of humanity and life itself."

Schweiss has built large doors installed at various SpaceX locations going back to 2008, including recent orders for a new steel hangar in Cape Canaveral. But doors required by SpaceX are not run-of-the-mill: the larger of the two is a Bifold Liftstrap door 90 feet wide by 61 tall. The second door on that shipment is 40 feet wide by 69 tall. Each is equipped with automatic latches and wind-rated to 150 mph. After they arrive at the site they will be clad in 26-gauge sheeting and fitted with four-inch blanket insulation. Bottom-drive 480 volt, three-phase motors and patented Schweiss liftstraps will do the lifting of these doors that exceed 46,700 pounds.

SpaceX maintains launch sites at Cape Canaveral Air Force Station, Kennedy Space Center in Florida, Vandenberg Air Force Base in California, and Boca Chica, Texas.

LISI AEROSPACE OPENS NEW PLANT IN MONTRÉAL

To mark its 10th anniversary, LISI Aerospace Canada announced an investment of more than $12 million in a new production line that will make titanium assembly components for the global aerospace industry. The investment will allow the company to hire 116 skilled workers over the next three years and maintain some 60 jobs in Dorval in Greater Montréal. Using an innovative fastener technology, LISI Aerospace Canada will be able to meet increasing demand from aircraft manufacturers for titanium or titanium alloy parts and strengthen the competitiveness of the entire Canadian aerospace industry.

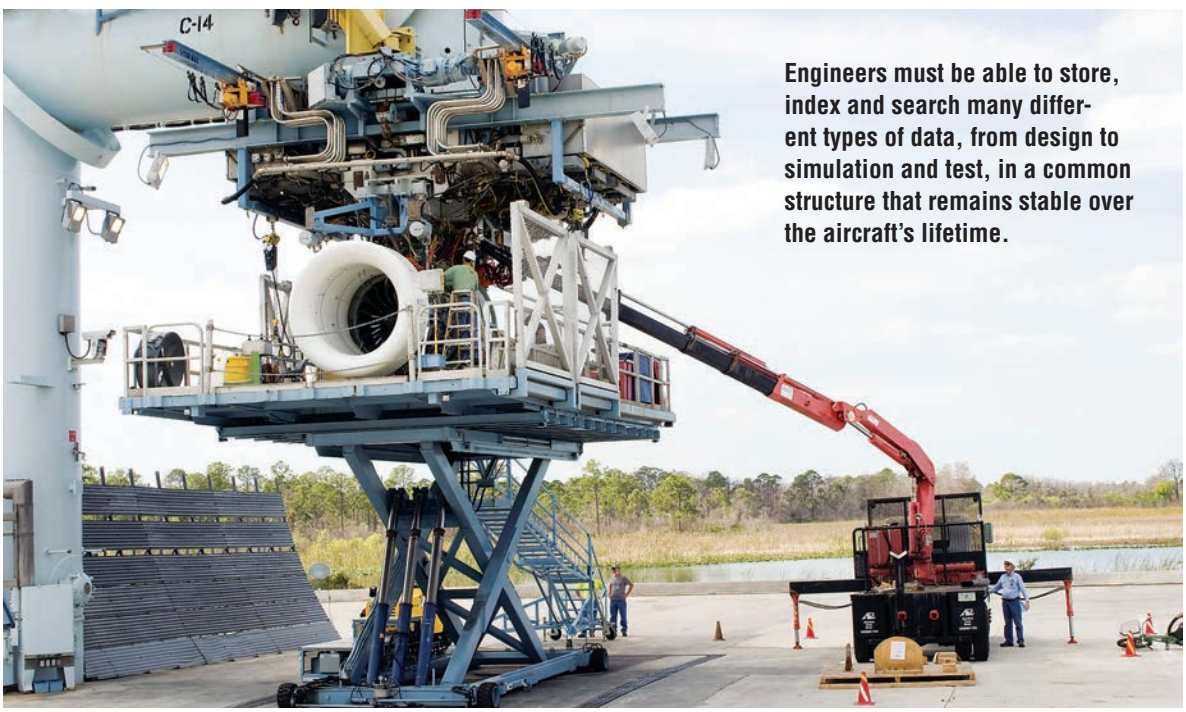
"The new plant will help LISI Aerospace Canada increase its production capacity by around 40 percent and position itself as the group's main integration centre," said Jean-Louis Colders, CEO of LISI Aerospace. "Thanks to our globally recognized cutting-edge expertise, we can design and produce top-quality, high precision parts used to hold plane or engine components together, by protecting them from contamination with oxygen, nitrogen, hydrogen or carbon during the forging process."

Greater Montréal is a world leader in aerospace alongside global centres like Seattle and Toulouse. Québec's aerospace industry ranks fifth in the world for number of jobs, behind the United States, France, Great Britain and Germany. Accounting for more than 43,500 jobs and over $12 billion in sales, the province's industry is a network of prime contractors, top-rated equipment manufacturers and close to 200 small businesses.

INTERNATIONAL CONFERENCE ON AIR VEHICLE DESIGN

"Sustainability 2015" will be the name and working theme of the inaugural American Helicopter Society conference when it gathers in Montréal, September 22-24. Sponsored by AHS International's Montréal-Ottawa Chapter, the conference is devoted to the sustainable design of air vehicles in the vertical flight and fixed-wing aircraft industries, covering the spectrum of environment issues as they affect the air vehicle's entire life cycle from conceptual design through manufacture, entry into service and end-of-life disposal/recycling. As part of Sustainability 2015 there will be an extensive technical exhibitors' space comprising large and small-to-medium enterprises offering specialist Design for the Environment and sustainability solutions and products. ■

Unleash the Power of the Internet of Things



Engineers must be able to store, index and search many different types of data, from design to simulation and test, in a common structure that remains stable over the aircraft's lifetime.

Engineering teams need immediate access to three categories of enormous datasets: geometry data, simulations and telemetry data. They also need to be able to aggregate this information. Right now, this data is scattered in hard-to-find/hard-to-reach silos. So, how can aviation companies realize the promise of advanced analytics for maintenance, repair, and overhaul?

By Manuel Terranova
With Pratt & Whitney photos

Predictive maintenance is expected to take a huge leap forward as the Industrial Internet of Things enables even more essential equipment to be packed with sensors for real time monitoring and aggregation of telemetry data. Data gained through these advancements is expected to help research, design, test and manufacturing teams learn more about infrastructures and subsequently improve products and services, uncover opportunities for new revenue streams, and pave the way for the next wave of innovation.

For example, the original schematics of an engine turbine may indicate what the lifespan of a blade should be under normal conditions. However when simulations are run, the data is likely to suggest factors that alter the original hypothesis—a rather frequent occurrence that causes problems on numerous levels for manufacturers, and their relationships with clients. Comparing this base information with real-time telemetry data from sensors on the turbine allows engineering teams to understand the factors behind those discrepancies, and make a case to preemptively perform maintenance before a problem surfaces, thus extending the life of the equipment and potentially enhancing safety.

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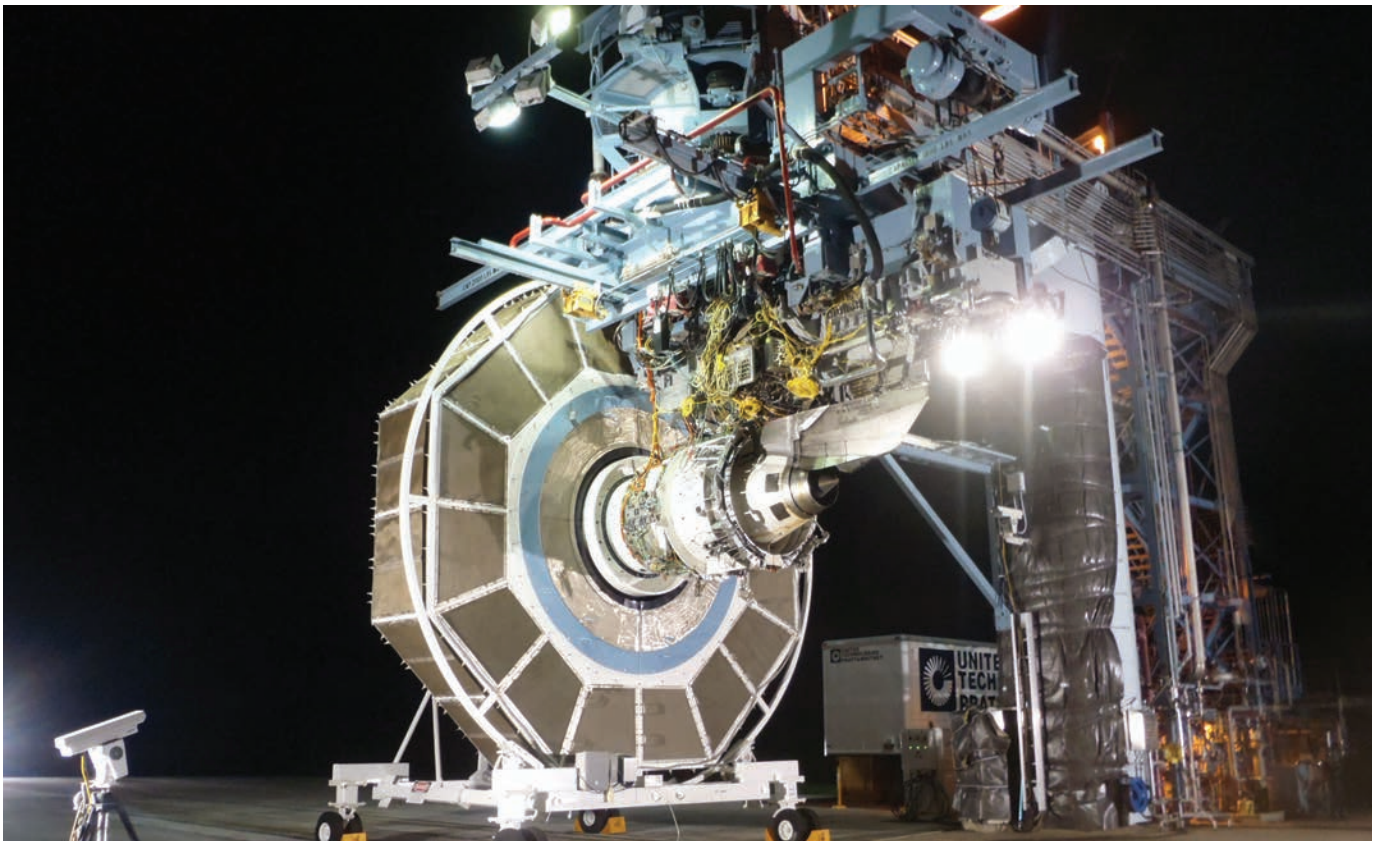
When telemetry data analysis points to potential design issues, a fast track back to the design information is needed.



By comparing telemetry data to empirically-based failure criteria, engineering teams may yet achieve "zero outage" ambitions.

As these insights are gleaned from the data and made readily available to the entire team, they enable proactive, preemptive services and more cost-effective delivery of all elements of maintenance, repair, and overhaul (MRO), and allow teams to uncover opportunities for new revenue streams. They also provide a foundation for a shared understanding of issues and opportunities for improvements to existing products that may reduce the time it takes to move an idea from inception to delivery. This shared understanding, furthermore, may inform new ways to design for serviceability, ensuring more efficient and convenient aftermarket maintenance.

Creating a fast track to the original design data

When telemetry data analysis points to potential design issues, a fast track back to the design information is needed. In such instances, it becomes necessary to come as close as possible to "recreating" the original design data sets by aggregating all of the associated structured and unstructured information. However, this is a challenging endeavor, to put it mildly, and today engineers spend a significant amount of their time just chasing down this data.

The process of locating and aggregating the original design and predesign data, admittedly, can be more like archeology than computer science. It's no secret that most organizations rely on "tribal knowledge," rather than a coherent data management strategy, to keep track of valuable data assets. But years past the original release, it may be difficult or even

impossible to find the knowledgeable engineers. Even when members of the original engineering team are accessible, there's no guarantee that they'll be able to recall where critical files are located. Thus, the process is often at the mercy of the fallibility of human memory.

What is required is comprehensive data access that includes aggregation and search across both structured and unstructured data. We must enable engineers to store, index and search many different types of data, from design to simulation and test, in a common structure that remains stable over the aircraft's lifetime. By creating a logical structure that overlays the overall massive data aggregation, the engineer may easily add design notes and other "informal" data to structured data. This makes it possible to come reasonably close to preserving a record of the entire design process—including the decisions behind the design, which are crucial to understanding the various "trade-offs" that may have been made in the design of precision equipment. Thus engineering teams are positioned to more quickly and cost-effectively address design issues.

Rethinking data management

Deriving the benefits of the Industrial Internet of Things for aircraft MRO will bring us many steps closer to achieving goals that have, up to this point, existed only as pipe dreams. By comparing telemetry data to empirically-based failure criteria, engineering teams may yet achieve "zero outage" ambitions, or successfully deliver "smart" products that automatically inform sustaining engineering teams in advance of problems. However, this requires new thinking that approaches data management in a holistic way, and breaks down the silos that keep information in the organization's dark corners. Furthermore, solutions must address the ability to store, index and retrieve not just certain obviously critical data sets, but all of the information surrounding a design. As the value of the whole data set may not be evident until years later, data must be aggregated and analyzed with an easy "trace back" to original data sets for team members across the process/value chain.

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The original schematics of an engine may indicate what the lifespan of a blade should be under normal conditions. However when simulations are run, the data is likely to suggest factors that alter the original hypothesis.

It's no secret that most organizations rely on "tribal knowledge," rather than a coherent data management strategy, to keep track of valuable data assets.

Services are needed that work behind the scenes to enable enterprises to easily store and manage data surrounding a part or machine both cost effectively, and over the entirety of its often multi-decade lifetime. To that point, organizations must address the considerable cost of storing data through a tiered storage scheme that keeps data on appropriate storage classes. Data which must be quickly and frequently accessed can be maintained on faster, more expensive storage mediums, while data which should be kept but may not be frequently needed may reside on less expensive ones.

Furthermore, data strategy and infrastructure must ensure the data is whole, and always available via remote and local replication, in order to maintain the full integrity of both data and the metadata that supports it, even through the complete loss of a server.

Moving Targets

Last but not least, data management strategy needs to account for the fact that data will be moved many times over the course of its life, and ensure that it can be retrieved just as easily years later as it can the day it is first stored and indexed. For many organizations the growth of data is outpacing the available storage. Thus data is frequently moved, both by individuals to personal drives, and by IT departments during "tech refresh" cycles to any number of data centers across the globe.

All this movement complicates the job of finding information. Likewise, data management for the next era requires the ability to access data assets through a single unified namespace that remains consistent over the life of the data set, providing a permanent path to access—wherever it is located. Essentially this will require "decoupling" the data from the location in which it physically resides, to ensure its retrievability, regardless of where it may be moved to over the course of its existence.

Keeping pace with unprecedented innovation

It's an exciting time as technology is enabling huge leaps forward, realizing a vision of predictive maintenance that will inform unprecedented advancements to products and services. This is rapidly changing the MRO landscape, and software that provides a large-scale data infrastructure is required to keep pace with and fully leverage these innovations.

Armed with both technology advancements in analytics and a solid data management infrastructure, engineering and maintenance teams will be able to deliver ever higher levels of quality and safety to the industry. ■

(Manuel Terranova is CEO & President at data management startup Peaxy.)


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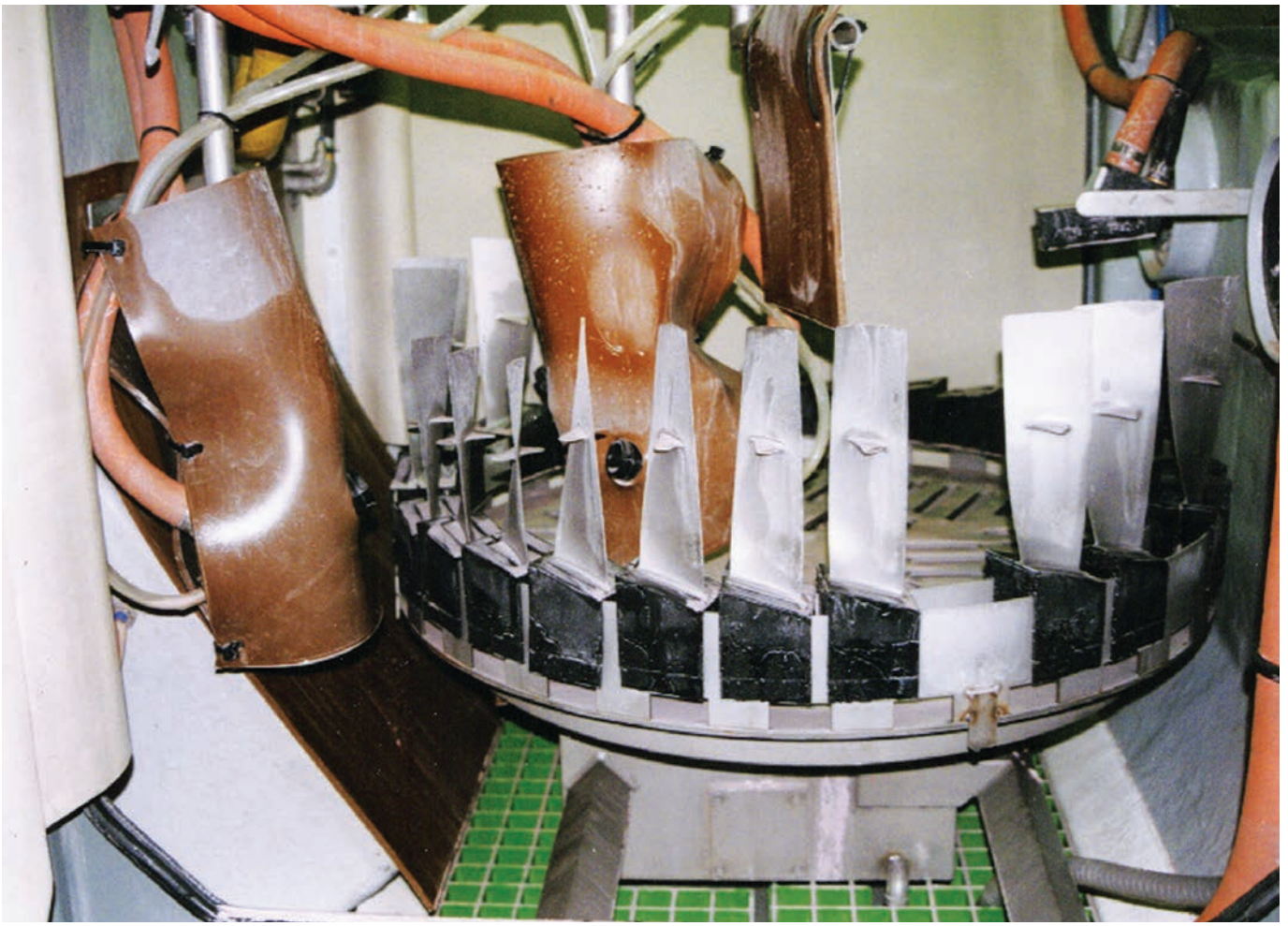
Cleaned, Treated, and *Good to Go*

Whether the job calls for big-scale surface prepping or smaller bits of cleanup, if consistency and safety are important, wet blasting might be just the ticket.

Aerospace companies value the versatility of the wet blasting process because from wheel cleaning to shot peening, it can accomplish a wide range of tasks, says Terry Ashworth, Technical Director at Vapormatt, a UK-based company that manufactures surface cleaning, peening and finishing machines (www.vapormatt.com). Wet blasting uses a suspension of solid particles in a carrier liquid, usually water, to treat the surface of a material. The suspension, or "slurry" is mixed with a pressurized gas, and forced through a nozzle and onto the material's surface. These different elements can be varied widely in order to have a particular effect. Heating the water and adding detergents and plastic "scrubbing" particles makes it appropriate for cleaning; but ramping up nozzle pressure and incorporating harder particles like alumina or ceramic will prepare metal surfaces for processes like bonding—or even strengthen them through peening.

This single process can accomplish a wide variety of industrial tasks, from mild cleaning through surface grinding to shot peening. It is this versatility, as well as its inherent safety (it creates no dust or statically charged parts) and enhanced chemically active surface, which are seen as key benefits by the aerospace sector.



Pictured above: a Wet Blasting jig.

On first inspection, wet blasting looks like spraying a surface with dirty water. But careful selection of the abrasive particle, nozzle pressure, water temperature and other factors allows it to be used in a multitude of applications: peening of turbine and fan blades; preparation of surfaces for bonding and painting; paint stripping (without substrate damage); degreasing, derusting and descaling; and general cleaning for overhaul. With very fine sharp media it can be used to prepare components for non-destructive testing (NDT), such as crack detection.

Liquid versatility

The liquid nature of wet blasting makes it highly versatile: altering the abrasive medium can change the process from one of cleaning to one

Pictured above: Sabre

of surface treatment. But the main advantage is its surface finish: the lubricating effect of wet blasting creates a flow of abrasive over the material, allowing more complex shapes to be processed, giving a surface that is more uniform and better prepared for coating, painting or bonding. Other advantages include small footprint, low wear on parts, low breakdown of solid media, effective filtration and separation of abrasive particles, and no need for pre-cleaning or degreasing.

Slurry composition is critical. What comes out of a wet blasting nozzle may appear unchanging, but underlying parameters can be altered and controlled to vary the process. The most advanced systems use software control to combine and monitor the flow of gas, air and solids. The nature of the abrasive medium has the largest effect on the process. A tough particle like silicon nitride will have a very different effect to something soft like sodium bicarbonate. The shape, hardness and size of the particle determine its abrasive effect.

Larger particles have a greater effect than smaller ones. Aluminum oxide, for example, achieves a "cutting" effect and creates a matte finish. A silicon glass bead gives a "polished" finish, while ceramic, plastics and steel particles have effects of their own. Many other media can be used, including bauxite, glass and even plum stones or walnut shells.

But other factors are also important. The number (and nature) of nozzles will lead to widely varying effects, as will the angle at which they are deployed. Air pressure determines the speed at which the slurry shoots out of the nozzle, and the kinetic energy of the process.

By specifying and controlling these and other parameters, users get the exact effect that they need, from preparing a composite surface for bonding to deburring a complex machined component tool. Today's most sophisticated wet blasting machines allow close control of media concentration, process temperature, additives and blast pressures for a consistent, reproducible surface finish that can be changed with relative ease.

Large and small

Component size is not a limiting factor, as the technique can be used for everything from nuts and bolts to wing spars. Small and large parts commonly receive identical treatment: tiny fixings may undergo the same surface treatment as a large forging, especially if the parts are later attached together. But this treatment can be achieved in different ways. Small fixings, for example, would be treated in bulk in a tumbling barrel. But a part like a wing spar would be set up in a large chamber, and then blasted by robotic or servo-controlled nozzles moving across its surface.

Traditionally, this was a manual process: an operator in a protective suit would pick up the blasting gun and treat the entire surface of the part. Some processes, such as cleaning aircraft wheels to test for underlying cracks, can still be done manually, but automation has become far more prevalent in wet blasting, as it has for many other industrial processes. For large parts like wing spars, automation ensures consistency. In highly regulated industries like aerospace the quality of each part needs to be identical. This is achieved by treating each one in exactly the same way, with no variation.

A good example is when treating the surface of an aerofoil, allowing a deicing strip to be glued to it. Automated wet blasting ensures consistent surface cleaning, which guarantees an identical

bond every time. For small parts, the main advantage of automation is to save time and money, as treating many separate parts by hand can prove impossibly costly.

Testing time

Automated wet blasting is also becoming more popular as a way of preparing a material surface for NDT. Prior to wet blasting, this might have been done using acid etching, in which the component is immersed in an acid bath. For obvious reasons, wet blasting is far less hazardous, and so is increasingly preferred.

Preparing a surface for NDT comes at the less abrasive end of the wet blasting spectrum. The aim of the operation is to create a clean surface without hiding or filling microscopic cracks, so that it can be analyzed for cracks and other potential defects. The better prepared the surface, the more accurate the test results will be.

Newly manufactured parts can be treated in this way, prior to testing for cracks. But it is most often used as part of the maintenance process, when it must first remove burnt-on carbon before proceeding to the "real" surface of the material. Test parts, which can range from nuts and bolts up to large components like combustion casings, are usually wet blasted with aluminum oxide of 180- to 200-mesh or finer. Manual cleaning might appear acceptable, as this seems little more than a surface cleaning process but automated wet blasting is far more consistent.

Above: Sabre inside

Automation ensures that the entire part is blasted evenly, meaning that it will have uniform cleanliness and activity across its surface, leading to more accurate test results. An ideal part to treat in this way might be a bogie beam, which has so many profiles and angles to blast that it can only be done properly on an automatic machine with four-axes of movement. When used for shot peening, wet blasting is tightly controlled, especially with regard to the level of abrasive particles that remain in the slurry.

This monitoring is just as important when preparing a surface for NDT, to ensure that the surface is not damaged: an expensive part like a combustion casing could be ruined if it were "over-blasted" such as by being blasted for too long, or at excessive pressure. Components such as combustion casings are weighed before and after they are tested, to check that the cleaning process has not accidentally removed any material from the surface.

Monitor and control

Managing the wet blasting process requires about 15 parameters to be controlled. These include: pressure and volume of air, slurry pressure, water temperature, pH and conductivity; filtration, rinsing, drying, and gun (nozzle) angle, range and speed. However, it is not enough simply to measure these levels. The process must also be controlled automatically, and one of the most important measurements is the level of particulate in the slurry. As abrasive particles begin to break down the process starts to lose its effectiveness. This means adding more abrasive particles to the slurry in the correct proportion, and at the same rate at which existing particles are breaking down.

The concentration of abrasive particles is usually 15-20 percent by volume. Whatever the concentration required, maintaining this accurately relies on close control of the process, which Vapormatt, for instance, achieves through elutriation towers. These work on the principle of Stokes' Law, which states that the rate of fall of a particle through a fluid is related to its size and density. So, as the slurry is recycled, it is fed into a column of water that is pumped upwards: larger particles fall quickly to the bottom, while smaller ones remain at the top and are removed.

By using elutriation towers very fine media can be used — with some machines designed to blast with 500-mesh where the particles are as small as 10 microns.

The second stage of the process is to measure how many "good" particles are left, and constant monitoring of slurry concentration with a density meter does this. By detecting when too many particles have broken down (and are removed), new particles can be added automatically.

The aerospace industry has many industrial processes to carry out: cleaning; polishing; surface preparation; peening. Many of them can be achieved through this single, flexible technique. By investing in wet blasting, aerospace companies can perform many separate industrial operations, which might otherwise require investment in several different technologies. ■

SFAR 41 maintenance category change

The following was received in response to a query our board sent to TCCA regarding the changes of policy to SFAR 41C aircraft:
"TCCA is in the process of developing an Internal Process Bulletin (IPB) to officially inform our Regional Offices and TCC's of the new assessment policy. The new policy will state that experience and skill obtained on SFAR 41C aircraft will only be applicable towards obtaining an M1 rating. The rationale for this change is that the AWM 523 now contains airworthiness standards pertaining to Commuter Category aircraft.

"This new policy will come into effect following an implementation period, which I think will be 12 months. During the implementation period AME licence applicants will be able to apply for either an M1 or M2 rating but not both using SFAR 41C experience and skill.

"The IPB will be followed with an Advisory Circular (AC) that will replace ANC004 and will contain the new policy regarding SFAR41C aircraft. Nothing has changed with regards to privileges, as M1 and M2 licence holders will continue to have privileges on SFAR41C aircraft including their derivative models."
Jeffrey Phipps Chief, Operational Airworthiness (AARTM) Standards Branch Transport Canada, Civil Aviation

A message from the President of the Helicopter Association International

Who needs training? Everyone!

I've noticed that when we talk about training in our industry, we tend to focus on the pilots. Don't get me wrong; pilot training is a cornerstone of HAI's safety initiatives. A pilot is the final safety gate for all flights, shouldering the ultimate responsibility for the safety of crew, passengers, and aircraft. While we recognize the benefits of pilot training, it is shortsighted to think that training belongs only in the cockpit. For example, maintenance staffers are absolutely critical to achieving safe and successful operations, yet their training often does not receive the same attention as that for pilots. We should look at training and development for every staff member, including flight crews, maintenance technicians, flight dispatchers, aircraft schedulers, administrative support, and management, as well as pilots. This approach is aligned with the principles of safety management systems (SMS). First, safety and operational performance are linked: when you improve one, you improve the other. Increased safety and performance in turn affect the financial viability of your organization.

Second, all staff members are key to the success of an organization's safety program. While pilots are the final safety gates, we now recognize that each staff member contributes to a safe flight. Accordingly, training should be developed and implemented for all staff members of an organization, from the entry-level employee up to and including the executive management and owner.

At a minimum, all staff members of a business should be schooled in that organization's mission, policies, and procedures. This may seem too basic to mention, but this foundation is necessary for everyone to work in a coordinated, interdependent, and supportive manner. Unless you have a payroll of one, every business depends on the teamwork of various departments and specialists working together.

Subsequent training would focus on individuals' specific duties, the technical requirements of their positions, and how they can contribute to their own safety and that of their co-workers and customers. When you step back and look at how each individual contributes to the success of the operation, the value of a structured training program for each individual becomes apparent.

When assessing training needs for your organization, don't forget to look in the mirror. Owners, executives, and management personnel all need to be involved in professional development programs too. This may shock some, but even I do not know all things and need training. In building your professional development program, you'll have many choices. But I urge you to always train to a higher level, beyond the minimum legal and regulatory requirements. Train your personnel to conduct their responsibilities as though every detail matters—because in our industry, it does.

Just as we have initial and recurrent training for pilots, you should consider the life cycle of professional development for all employees. Training isn't just a box to check off; many employees will benefit from periodic refresher or advanced courses. The benefits of a well-developed, comprehensive training program are many. The most notable are the prevention of accidents, injuries, and death. However, both commercial and general aviation/private operations can also reap enhanced operational efficiencies that will translate into improved financial performance. Commercial operators should realize retention and expansion of the customer base.

If you are one of those people who think you already know everything and therefore don't need professional development, think again. You probably need training more than anyone. As the great basketball coach John Wooden said, "It's what you learn after you know it all that counts."

Some of you may put off training because of cost concerns. This is understandable. My readers who maintain an aircraft for personal use have already sunk considerable sums into their passion. And for business owners, the financial health of their operation is always top of mind. However, if you think training costs too much money, let me assure you, that expense will pale in comparison to the cost of an accident. To really analyze training costs, you should also look at how much you are losing because of operational inefficiencies, not to mention the revenue lost to your competitors. Well-trained, safety-oriented employees have the best chance to produce the safest, most efficient operations. There is a solid business case for training, and it's time for us all to get on board.

That's my story and I am sticking to it. Let me know what you think: tailrotor@aol.com.

— *Matt Zuccaro, President and CEO of HAI*
www.wamea.com

Atlantic AME Association

About Us

The Atlantic AME Association is one of five similar associations across Canada; the others being the Western, Ontario, Central and Pacific associations.

These associations represent regional interests, as well as, concerns of national importance. The Canadian Federation of Aircraft Maintenance Engineers Associations (CFAMEA) is a national body, which is supported and financed by all the regional associations and which represents the associations at the national level.

The purpose of the association is to maintain and enhance the standards of professionalism of the AME and the aircraft maintenance industry as a whole and to protect the rights and privileges of the AME. The association works with and is consulted by Transport Canada in the formulation of new rules and regulations to promote the viewpoint of the AME. We are represented on various committees and working groups involved with aircraft maintenance and licensing.

www.atlanticame.ca

Central AME Association

About Us

The Central Aircraft Maintenance Engineer Association is an organization dedicated to maintaining and enhancing the standards, rights and privileges of all AME members in the central region of Canada. Our chapter is one of five similar associations across Canada that collectively supports the national body CFAMEA. Our organization works with Transport Canada in the formulation of new rules and regulations and provides a collective viewpoint for all AMEs. CAMEA is a not-for-profit organization run by a volunteer group of AMEs. We elect members of our organization to be part of our Board of Directors. Members of CAMEA are comprised of AMEs, AME apprentices, students, non-licensed persons working in the industry and corporate members.

email: camea@mymts.net

AME Association of Ontario

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A Message from the President

I would like to take this opportunity to thank the Board of Directors for their nomination and their ongoing support as I transition from Vice President to President of our Association. For over 25 years I have been an avid supporter of this organization. I truly believe it does a great deal of good for the aviation community. I consider it a great honour to hold this position and will continue to do my best for our members and all aircraft maintenance practitioners across Ontario.

In addition, I would like to welcome Steve Farnworth to the role of Vice President. Steve has always served the Association with distinction in his many roles and is another tireless, positive, hardworking individual. I must also thank our past President, Warren Couch, for his hard work and dedication over the past years.

In closing, I would like to put forth a challenge for more members to get involved. Please help us make an already great Association even better. We need your input, your participation and your passion to push the boundaries. Together we can kick it up a notch and take it from great to fantastic and beyond! — Sam Longo

Annual AME Workshop and AGM

Planning continues for our annual AME Workshop scheduled for September 30 to October 2 at the Hilton Meadowvale Conference Centre in Mississauga. (That's not a typo! The conference centre is now part of the Hilton chain.)

Again this year we will be having two days filled with educational sessions as well as a full house of displays from industries supporting aircraft maintenance. We have quality T-shirts with our association logo and unique design for sale at the annual meeting. They are available with the printing on either the front or the back. Only $20 tax included! Check our web site at www.ame-ont.com for the latest details. We look forward to seeing you there!

— *Submitted by Stephen Farnworth for the Board of Directors*

CENTRAL OHIO

Central Ohio PAMA

COAGO 2015 registration in full swing

Registration for the 2015 Central Ohio Aviation Golf Outing (COAGO), to be held on Friday, September 11, is now open. This will be the 13th year that the outing has been co-hosted by COPAMA and the Professional Pilots Association (PPA) to raise funds for the COPAMA Scholarship Fund.

We will return to Kyber Run Golf Course, just outside Johnstown, Ohio. Please visit the new registration website www.birdeasepro.com/coago2015 for both sponsors and players, which will use PayPal for exclusive credit card transactions. For information on other payment methods please contact us at golf2015@copama.org. Updates on the event will be available here on our website. Hope to see you there!

May 12th meeting: Lycoming Engines

Our May meeting was held in Lane Aviation's Media Room with the topic of the night "Engine Care and Maintenance" presented by Dennis Coulbourn, Regional Sales Manager of Lycoming Engines. Dennis started his show with a history about Lycoming and their factory in Williamsport, Pennsylvania, where they've been building engines for 99 years with their first aircraft engine, the R680 radial coming off the assembly line in 1929. He showed the many engines that they have produced over the years, and expanded on their latest technology that includes electronic controls to produce more power and fuel-efficiency, regardless of which fuel is being used. Their goal is to provide engines that will run on upcoming fuels and automotive gasoline as aviation grade 100 low lead is nearing its end of production. Dennis also discussed Lycoming's product support and some of the issues they see at their repair facility. Oil grades and analysis, tips on keeping the engine running cool and starting techniques for hot engines. He drew on his eight years on the production line to answer questions and show the web-based resources that Lycoming has for its customers around the world.

We want to thank Dennis and Lycoming for his travel to be with us in Columbus and his informative presentation. The meeting was posted on the FAA Safety website and those who attended received a one-hour credit toward the AMT/WINGS awards. We now break for the June through August summer break and hope to see everyone at the Central Ohio Aviation Golf Outing on September 11.

www.copama.org

SOCAL

PAMA SoCal Chapter

Flight Displays Systems

The SoCal Chapter would like to thank John Berizzi, Regional Sales Manager and all at Flight Display Systems for their time and generosity in hosting the April 2015 Chapter dinner meeting and excellent technical presentation on "Cabin Management Systems & In-Flight Entertainment" at the 94th Aero Squadron Restaurant in Van Nuys, CA. To learn more about Flight Display Systems, visit www.flightdisplay.com

2016 Scholarship Applications

Coming this fall to www.SoCalPAMA.org are the A&P Student Scholarship and the A&P/IA Continuing Education Scholarship. The deadline is May 2, 2016 with the Awards Presentation scheduled for June 14, 2016. This is open to all Southern California residents currently enrolled in good standing in an accredited A&P or IA Training School/Program.

www.socalpama.org

PAMA DFW

PAMA Dallas – Fort Worth

About Us

The DFW Chapter of PAMA is a non-profit association dedicated to promoting professionalism and recognition of the Aviation Maintenance Technician through communication, education, representation and support, for continuous improvement in aviation safety.
email: curtislandrum@charter.net

www.pamadfw.com

The Fly-by-Wire Chopper

The digital suite of the newly launched Bell 525 Relentless may signal an unprecedented era of control and freedom for helicopter pilots.

In our Industry Forum department this issue there's an item about the maiden flight of Bell's long awaited 525 Relentless. Here we take a longer look at the aircraft that Bell claims will revolutionize the industry as the world's first fly-by-wire (FBW) commercial helicopter.

In the case of the Relentless, FBW technology replaces the traditional manual flight controls with a digital interface that provides a level of control "previously unseen in a commercial helicopter." It features the Garmin G5000H, a fully integrated touch screen avionics suite that complements a helicopter Bell claims has best-in-class payload, cabin, cargo volumes, and passenger comfort.

"The marketplace has been awaiting the transformational capabilities of the Bell 525 and we continue to see growing customer demand from around the globe for this aircraft," said Matt Hasik, executive vice president of commercial programs at Bell Helicopter.

With a cabin configured for 16 passengers and two flight-crew, the Bell 525 Relentless is powered by two General Electric CT7-2F1 engines that deliver a max cruise speed of 155 knots (287 kmh) and shoulder an external load of 21,000 pounds (9,524 kg). Overhead, a five-bladed, fully articulated, main rotor hub has full de-ice capability and at least some bird strike tolerance, while at the back the tail boom construction features an anti-torque system and a four-blade tail rotor. The airframe is a blend of metals and composites that keep the max gross weight of the aircraft under 20,000 pounds.

With over 60 helicopters reserved under letters of intent, the Bell 525 is designed to provide operators and end users "unmatched situational awareness and the ability to perform a wide variety of missions under challenging weather conditions." Missions range from oil and gas, to corporate, para-public, HEMS, and firefighting.

All of which is great, but most AMEs will likely appreciate that Bell created a standard tool kit for the 525 Relentless, and claims all line replaceable units (LRUs) are replaceable within 30 minutes or less, meaning the aircraft can be back in the air within a matter of minutes. There's also a limited list of common fasteners, preventing annoyances like finding a Phillips-head screw next to a Torx-head screw. Similarly, fasteners within the same row are required to have the same grip length. To further simplify things, all panels are interchangeable, even the windscreens.

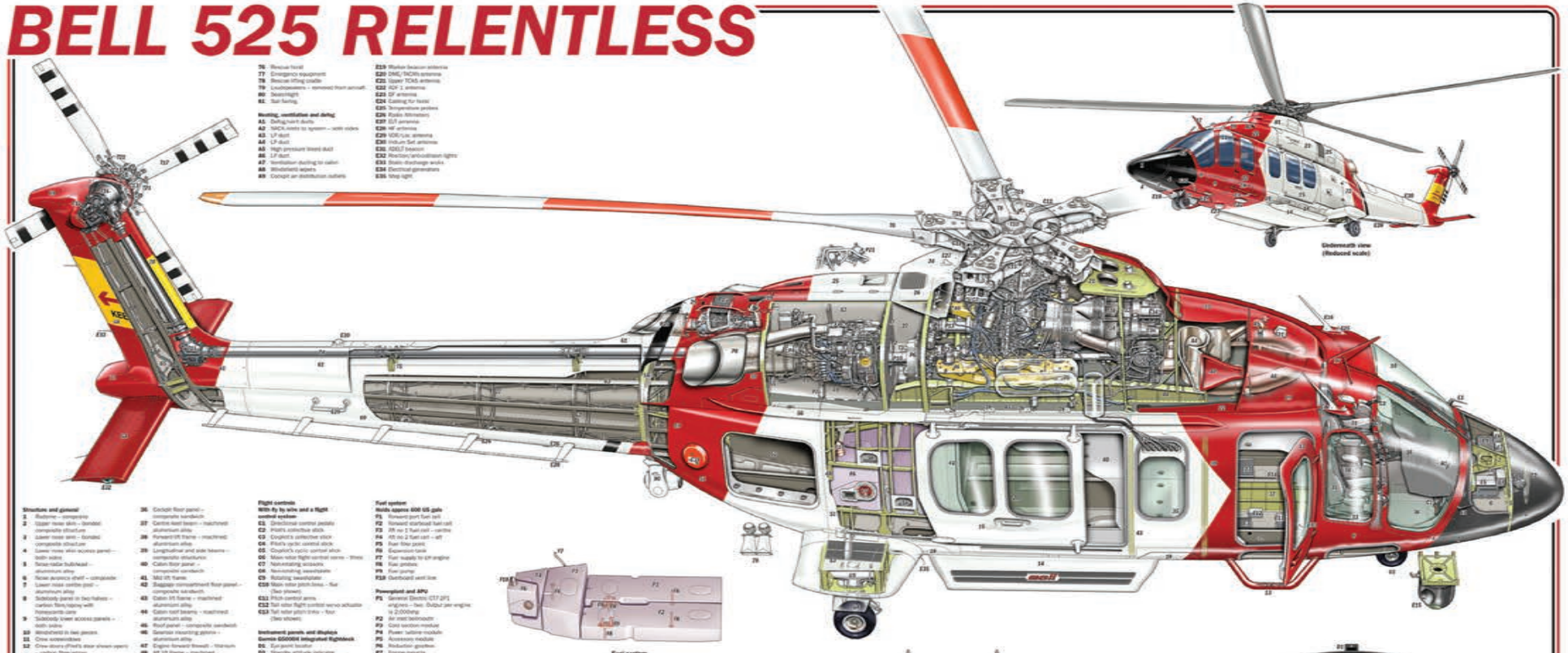
In a classic case of "walk a mile in my shoes" Bell challenged the 525's engineers to experience their designs from the perspective of a maintenance environment: the engine design team changed an engine while the fuel system design team removed fuel tanks and fuel system components. And the drives team removed and replaced gearboxes and drive shafts. The result of this collaboration between design and maintenance were gained efficiencies of maintainability, says Bell.

The Bell 525 Relentless is supported with an interactive electronic technical manual (IETM), three-dimensional virtual graphics with animation, and interactive wiring diagrams, as well as publications directly linked to the IVHM system. Maintainers can view graphics from any angle and virtually disassemble complex assemblies directly on the maintenance floor, and by linking into the IVHM systems maintainers no longer have to launch multiple applications, but can use one source to troubleshoot a problem.

But from nose to tail, the aircraft was designed with the operational functions of pilot and flight crew at top of mind. "When we started designing the Bell 525, our customer advisory panel really stressed the need for a flying

Lift-off: first flight of the Bell 525

BELL 525 RELENTLESS



Underneath view
(Reduced scale)

Structure and general

1 Radome – composite
2 Upper nose skin – bonded composite structure
3 Lower nose skin – bonded composite structure
4 Lower nose skin access panel – both sides
5 Nose radar bulkhead – aluminium alloy
6 Nose avionics shelf – composite
7 Lower nose centre post – aluminium alloy
8 Sideboxy panel in two halves – carbon fibre/epoxy with honeycomb core
9 Sideboxy lower access panels – both sides
10 Windshield in two pieces
11 Crew sunwindows
12 Crew doors (Pilot's door shown open) – carbon fibre/epoxy
13 Forward door access step
14 Passenger door access step
15 Sliding passenger door (Shown pushed back in main drawing) – carbon fibre/epoxy
16 Glare shield
17 Cable cutter (Optional)
18 Access covers
19 Forward fairing – hinged composite sandwich panel
20 Cabin centre keel
21 Outlet panel for blower and electrical generator exhausts
22 Forward ECU fairing (Only partially shown on main drawing) – composite sandwich panels
23 Transmission cowl doors – composite sandwich panels
24 Aft upper fairing – composite sandwich panel
25 Engine access panel – only one shown
26 Engine inlet barrier filter
27 Engine inlet and gearbox plenum
28 Transmission cowl door hinges
29 Auxiliary power unit (APU) fairing
30 Engine exhaust fairing
31 Crew seats – two (Both seats have tracks that allow them to rotate and translate aft)
32 Passenger seats – collapsible
33 Seat chassis
34 Pedestal
35 Cabin side window
36 Cockpit floor panel – composite sandwich
37 Centre keel beam – machined aluminium alloy
38 Forward lift frame – machined aluminium alloy
39 Longitudinal and side beams – composite structure
40 Cabin floor panel – composite sandwich
41 Mid lift frame
42 Baggage compartment floor panel – composite sandwich
43 Cabin lift frame – machined aluminium alloy
44 Cabin roof beams – machined aluminium alloy
45 Roof panel – composite sandwich
46 Sawtooth mounting pylons – aluminium alloy
47 Engine forward firewall – titanium
48 Aft lift frame – machined aluminium alloy
49 Engine deck – metallic
50 Sliding door rail
51 Cabin side panels – composite
52 Baggage compartment – 1289ft³ useable volume
53 Sawtooth – machined aluminium alloy structure with composite skins
54 Aft fuselage to tailboom frame – machined aluminium alloy
55 Aft engine firewall – titanium
56 Maintenance foot hangs
57 Centre firewall between number 1 and 2 engines – titanium
58 Maintenance handholds and steps
59 Aft fuselage – carbon fibre/epoxy with honeycomb core
60 Tailboom – two piece bonded composite structure
61 Driveshaft covers – composite
62 Tailboom frames – composite
63 Tailboom longerons – composite
64 Horizontal stabiliser – composite construction
65 Vertical fin – composite construction
66 Vertical fin spars – composite
67 Vertical fin ribs – composite
68 Vertical fin skins – composite
69 Vertical fin fairings
70 Vertical fin leading edge
71 Tail fairing – composite
72 Baggage door – both sides
73 Medical attendants seats
74 Storage cupboard
75 Stretchers
76 Rescue hoist
77 Emergency equipment
78 Rescue lifting cradle
79 Loudspeakers – removed from aircraft
80 Searchlight
81 Bail fairing

Heating, ventilation and defog

A1 Defog/vent ducts
A2 NACA inlets to system – both sides
A3 LP duct
A4 LP duct
A5 High pressure bleed duct
A6 LP duct
A7 Ventilation ducting to cabin
A8 Windshield wipers
A9 Cockpit air distribution outlets

Flight controls
With fly by wire and a flight control system

C1 Directional control pedals
C2 Pilot's collective stick
C3 Copilot's collective stick
C4 Pilot's cyclic control stick
C5 Copilot's cyclic control stick
C6 Main rotor flight control servos – three
C7 Non-rotating swashplate
C8 Non-rotating swashplate
C9 Rotating swashplate
C10 Main rotor pitch links – five (Two shown)
C11 Pitch control arms
C12 Tail rotor flight control servo actuator
C13 Tail rotor pitch links – four (Two shown)

Instrument panels and displays
Garmin G5000H integrated flightdeck

D1 Eye point locator
D2 Standby attitude indicator
D3 Multi function display (MFD)
D4 Primary flight display (PFD)
D5 Annunciator panels
D6 Fire protection panel
D7 Engine control panel
D8 Electrical control panel
D9 Box control panel
D10 Lighting control panel
D11 ELT arming panel
D12 Landing gear control panel
D13 Garmin touch controller
D14 Parking brake
D15 Navigation and communication panel
D16 Emergency systems panels
D17 Hoist control panel
D18 Cargo hook control panel
D19 Approach plate holder
D20 Armrests for flight controls

Avionics and electrics

E1 Pitot heads – three
E2 Weather radar (Optional)
E3 Flight control computer no 2
E4 Xfer2.0
E5 FDP no 3
E6 Windshield ice protection controller (Optional)
E7 Controller – windshield wipers
E8 Air data computer no 3
E9 Flight control computer no 3
E10 GGD no 3
E11 GIA no 3
E12 ADM(R) no 2
E13 Flight control computer no 1
E14 GIA no 1
E15 EG/R (Optional)
E16 Gnn 1/Gps 1 antenna
E17 Gnn 2/Gps 2 antenna
E18 Lower TCAS antenna
E19 Radar beacon antenna
E20 DME/TACAN antenna
E21 Upper TCAS antenna
E22 ADF 1 antenna
E23 DF antenna
E24 Cabling for hoist
E25 Temperature probes
E26 Radio Altimeters
E27 ELT antenna
E28 HF antenna
E29 VOR/Loc antenna
E30 Iridium Sat antenna
E31 ADELT beacon
E32 Position/anticollision lights
E33 Static discharge wicks
E34 Electrical generators
E35 Map light

Fuel system
Holds approx 600 US gals

F1 Forward port fuel cell
F2 Forward starboard fuel cell
F3 Aft no 1 fuel cell – centre
F4 Aft no 2 fuel cell – aft
F5 Fuel filler point
F6 Expansion tank
F7 Fuel supply to aft engine
F8 Fuel probes
F9 Fuel pump
F10 Overboard vent line

Powerplant and APU

P1 General Electric (T7-2P1 engines – two. Output per engine is 2,000hp
P2 Air inlet bellmouth
P3 Core section module
P4 Power turbine module
P5 Accessory module
P6 Reduction gearbox
P7 Engine mounts
P8 Turbine exhaust duct
P9 Ejector box
P10 Drive shaft from engine to reduction gearbox
P11 Hamilton separator blower and overboard dump
P12 Engine oil tank fill port
P13 Drive shafts from reduction gearbox to main gearbox
P14 Honeywell RE100XR APU
P15 APU inlet barrier filter
P16 APU inlet plenum
P17 Air turbine starter
P18 APU starter generator
P19 APU starter generator inlet duct
P20 APU turbine exhaust duct
P21 Two fire bottles mounted on the inboard side of the left hand skin port forward of the cargo door opening – shown removed from aircraft for clarity
P22 Starter air valve

Rotors and transmission

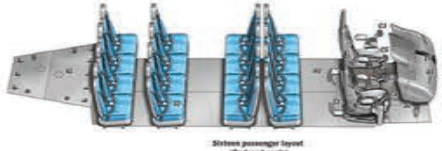
T1 Main rotor gearbox
T2 Main transmission (ZFE mounts
T3 Tail rotor drive shaft tunnel
T4 Tail rotor drive shafts – four composite and one aluminium shaft
T5 Tail rotor drive shaft hanger bearing assemblies – three (Two shown)
T6 Composite main rotor blades – five (Two not shown)
T7 Main rotor yoke
T8 Main rotor grip assembly
T9 Blade bolts
T10 Pitot nut
T11 Drive shafts from main rotor gearbox to accessory gearbox
T12 Accessory gearbox
T13 Oil cooler transition duct
T14 Oil cooler blower – fan
T15 Intermediate gearbox
T16 Tail rotor gearbox
T17 Composite tail rotor blades – four
T18 Tail rotor yoke
T19 Main rotor blade tag damper
T20 Swash
T21 Tail rotor blade tag damper

Landing gear and hydraulics

U1 Aft retracting twin wheel nosegear
U2 Nosegear doors
U3 Inward retracting single wheel maingear
U4 Main landing gear door
U5 Hydraulic power pack – three
U6 Hydraulic ground cart quick disconnect
U7 Hydraulic lines – three separate sets of lines

Fuel system
(Reduced scale)

SAR layout
(Reduced scale)



Sixteen passenger layout
(Reduced scale)

Instrument panel
and pedestal

Tim Hall
Fort Worth, Texas

Triumph Group, Inc.

Bell Helicopter
A Textron Company

FLIGHT INTERNATIONAL From Flightglobal

Technicians monitor the initial flight of the Bell 525.

experience that's safer, easier and more repeatable," said Hasik. "We can design a product with class-leading speed, range, and a host of product features, but the real focus of the Bell 525 was to make a step-function improvement in capability for the pilot, enabling him/her to manage every aspect of flight in the cockpit with a new level of awareness and control."

The Bell 525 Relentless hosts a triply redundant flight control system in which pilot inputs are electronically transmitted and processed by the flight control computers. With three flight control computers and triplex electro-hydraulic actuators, the digital FBW control system provides full-authority stability, control, and guidance offering reduced pilot workload in pitch, roll, yaw and lateral and vertical motion.

Bell says that the FBW system can actually determine an intelligent and informed aircraft response in a number of situations and can automatically adjust commands to maximize flying precision and performance, resulting in a controlled, predictable response.

Cockpit of the Bell 525

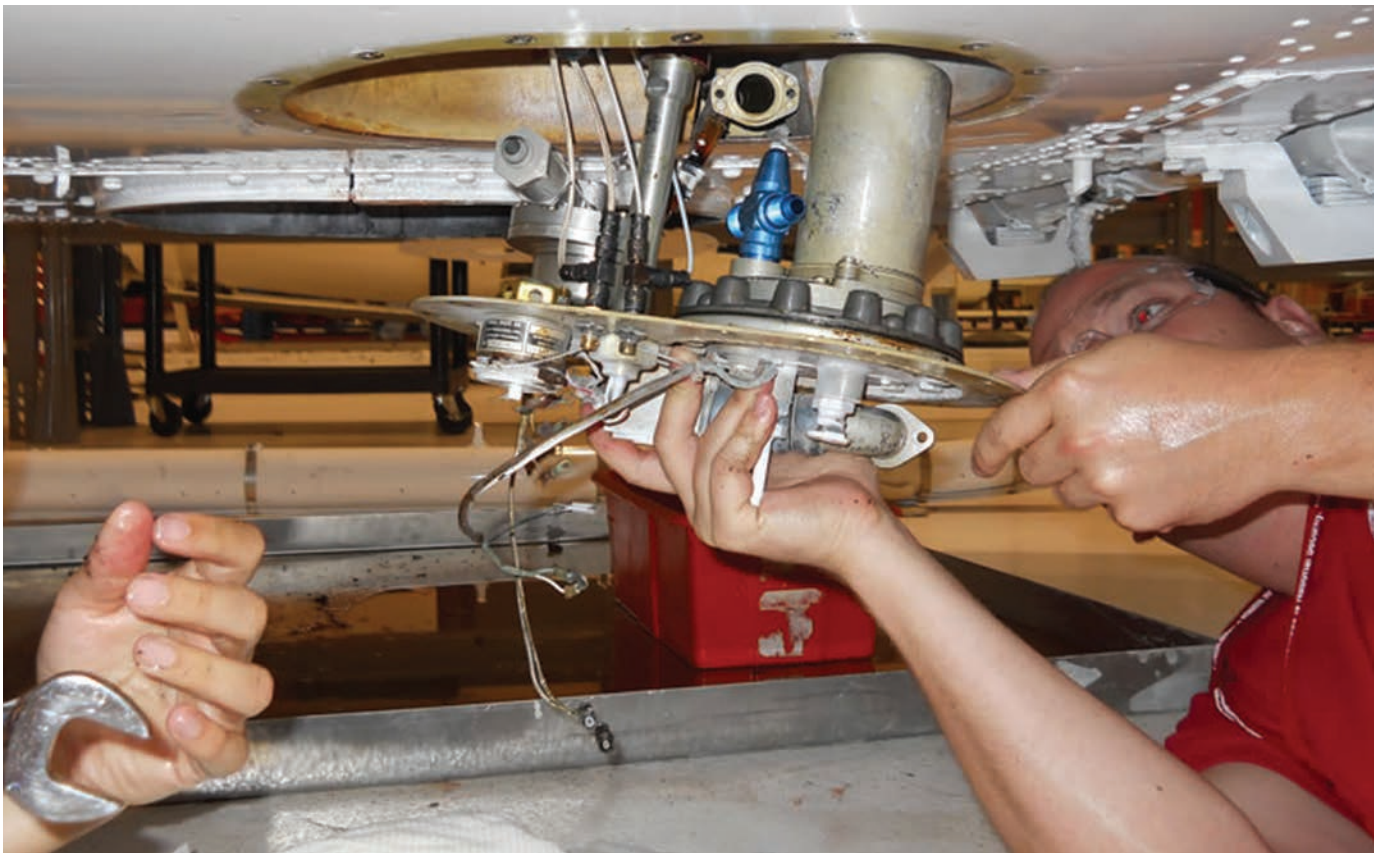
The intent is for pilots to easily maintain flight conditions and make smooth transitions between conditions without being distracted from other key aspects of the cockpit.

For example, if an engine loses power or an autorotation is needed, the aircraft can sense the situation and adjust instantaneously while the pilot begins to take appropriate action.

Fly-by-wire also makes the overall flying experience easier for operators. The flight control system and flight director interface can automatically fly the helicopter in a variety of modes, and the flight director can also be coupled to an autopilot system to provide hands-off navigation. However, if preferred, the pilot can also choose to decouple the flight director from autopilot and manually fly the Bell 525.

Since FBW removes the mechanical linkages in place in traditional helicopters, it also results in fewer parts and fewer mechanical repairs. Bell reports the elimination of "a significant amount" of intricate rigging by incorporating FBW technology while an integrated vehicle health monitoring system monitor analyzes and reports on collected data. All of this data and information can then be downloaded via Wi-Fi, SD card, wired Ethernet or by satellite communications (Satcom)—with Satcom, the operator receives feedback in real time. The ground station software gives the maintainer all information in one integrated set of applications—fault isolation data, maintenance data, IVHM data integration, parts ordering, logbook integration and aircraft readiness.

"Altogether, the Bell 525 Relentless [allows] pilots the freedom to do more quicker and safer than ever before," said Larry Hutson, Product Team lead on the Bell 525. ■



Installing components on the Bell 525

Didn't see this coming . . .

An undetected crack in the outer combustion case and an aging glue seam combine to put one big Sikorsky into the water.

At 1301 Pacific Daylight Time, the Helijet International Inc. Sikorsky S-76A helicopter 760052 departed Masset Airport, British Columbia, for a fishing lodge on Langara Island, British Columbia, with one pilot and one passenger on board. On final approach to land at the fishing lodge, No. 1 engine lost power. The pilot elected to ditch in the water with the emergency flotation system deployed. The helicopter settled on the water alongside a floating helipad, which was the intended landing site. After shutting down the helicopter, the pilot noticed that it was listing nose down and to starboard (right).

The pilot and the passenger evacuated the helicopter into a small boat that was dispatched to help; no one was injured. About four minutes later, the helicopter rolled inverted in the water. The emergency locator transmitter activated for about four seconds.

History of the flight

On the day of the accident, the helicopter was transporting an employee of the fishing lodge and cargo from Masset Airport to the lodge on Langara Island, British Columbia, which is about an 18-minute trip. Masset is located about 35 nautical miles (nm) southeast of Langara Island. The flight was carried out under visual flight rules (VFR) at about 500 feet over water, and the visibility was described as good.

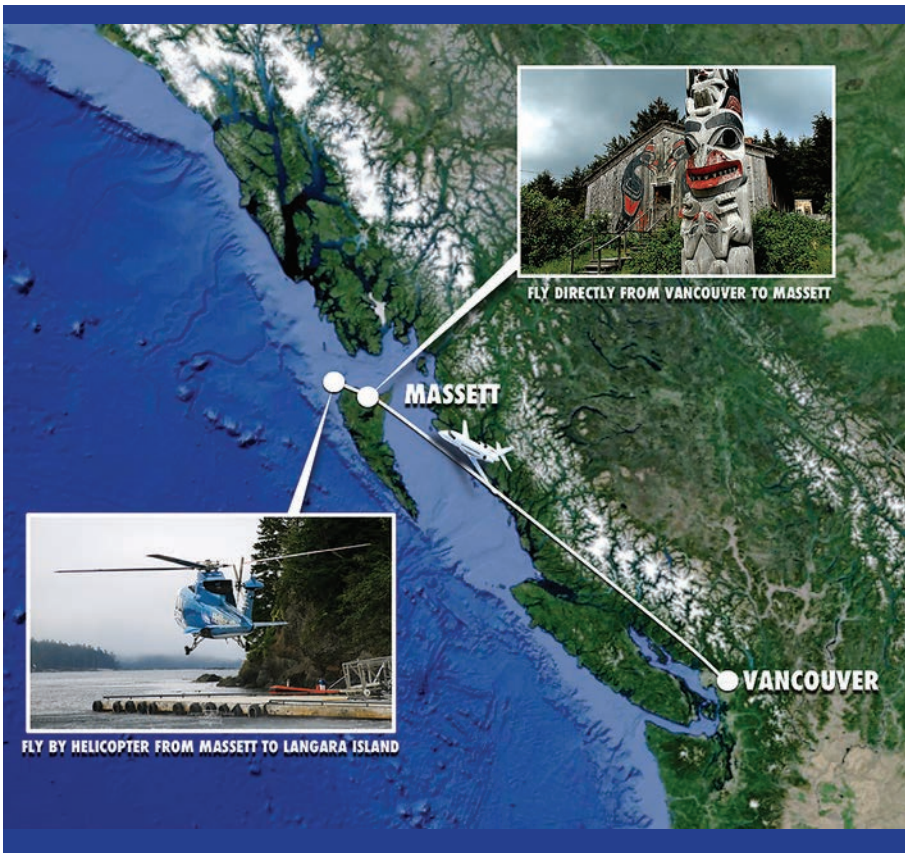
On short final to land at 1319, there was a loud bang, the engine-out warning horn sounded, and the No. 2 engine (Allison/Rolls Royce 250-C30S) lost power. At the time of the power loss, the helicopter was about 75 feet away from the helipad and 49 feet above the water, with an indicated airspeed of about 14 knots.

The pilot was in the process of beeping up the No. 1 engine to match the torques, as the No. 2 engine torque was indicating 95 percent and the No. 1 engine torque was between 80 and 85 percent. In response to the power loss, the pilot pulled up on the collective to decrease the rate of descent and pitched the nose down in an attempt to land on the helipad. It became apparent that the helicopter could not be landed safely on the small floating helipad. Therefore, the pilot stopped the forward flight of the helicopter and ditched in the water beside the helipad with the emergency floats deployed.

The helicopter settled on the water with the main rotor blades turning, sweeping over the northeast side of the helipad. All four floats were inflated. The ditching was accomplished with low impact forces, and the emergency locator transmitter (ELT) did not initially activate. The ELT emitted a brief signal upon submersion in the seawater. The helicopter drifted away from the helipad, and the pilot shut down the other engine. An observer via marine band radio advised the occupants that smoke was emanating from the No. 1 engine. The pilot pulled the fire handle for that engine and discharged the fire extinguisher. Both fire handles were found in the pulled/shut-off position after the helicopter was retrieved.

After the rotors stopped, the helicopter began to list to starboard, and the pilot called for the passenger to evacuate. The pilot and passenger exited without injury onto a small boat, which had been dispatched by the lodge. The starboard floats continued to deflate, and about four minutes later, the helicopter rolled inverted in the water, floated by only the port floats. The helicopter was later dragged close to shore and secured to a tree with a rope. A containment boom was placed around the helicopter in case of fuel and oil leakage.

Damage to the helicopter was initially limited to the engine, but the damage sustained by its submersion in salt water, and subsequent salvage, rendered it beyond economical repair. The starboard nose float was torn on the front lower outboard side. Some of the fabric was missing, and there was wrinkling deformation, consistent with the fabric having been snagged on an object. The pilot was highly experienced, with about 20,000 hours total flying time and about 8,000 hours on the helicopter type. The pilot held an airline transport pilot licence-helicopter, validated by a current medical certificate. The pilot had been trained and certificated to the appropriate standards and regulations.



Map indicating site of the crash.

Helicopter

The Sikorsky S-76A is a twin-engine, single main-rotor helicopter designed to operate with one or two pilots and carry up to 13 passengers. This helicopter type is certified to a maximum gross take-off weight (MGTOW) of 10,500 pounds. The occurrence helicopter was manufactured in 1980. Records indicate that it was maintained to the manufacturer and regulator's standards.

A weight and balance computation determined that the helicopter was being operated within its load and centre of gravity limits. At the time of the occurrence, the helicopter's gross weight was about 9,725 pounds.

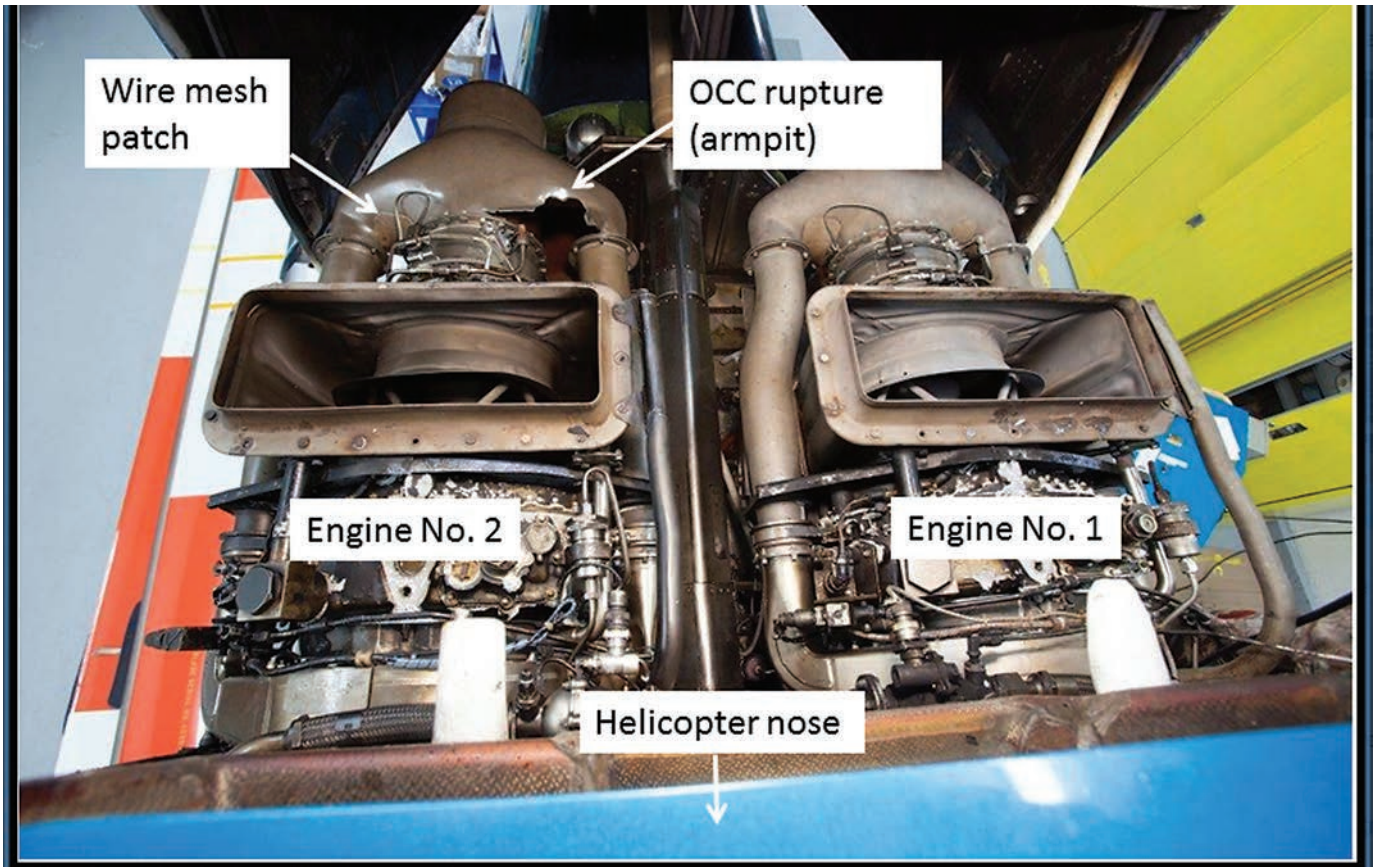
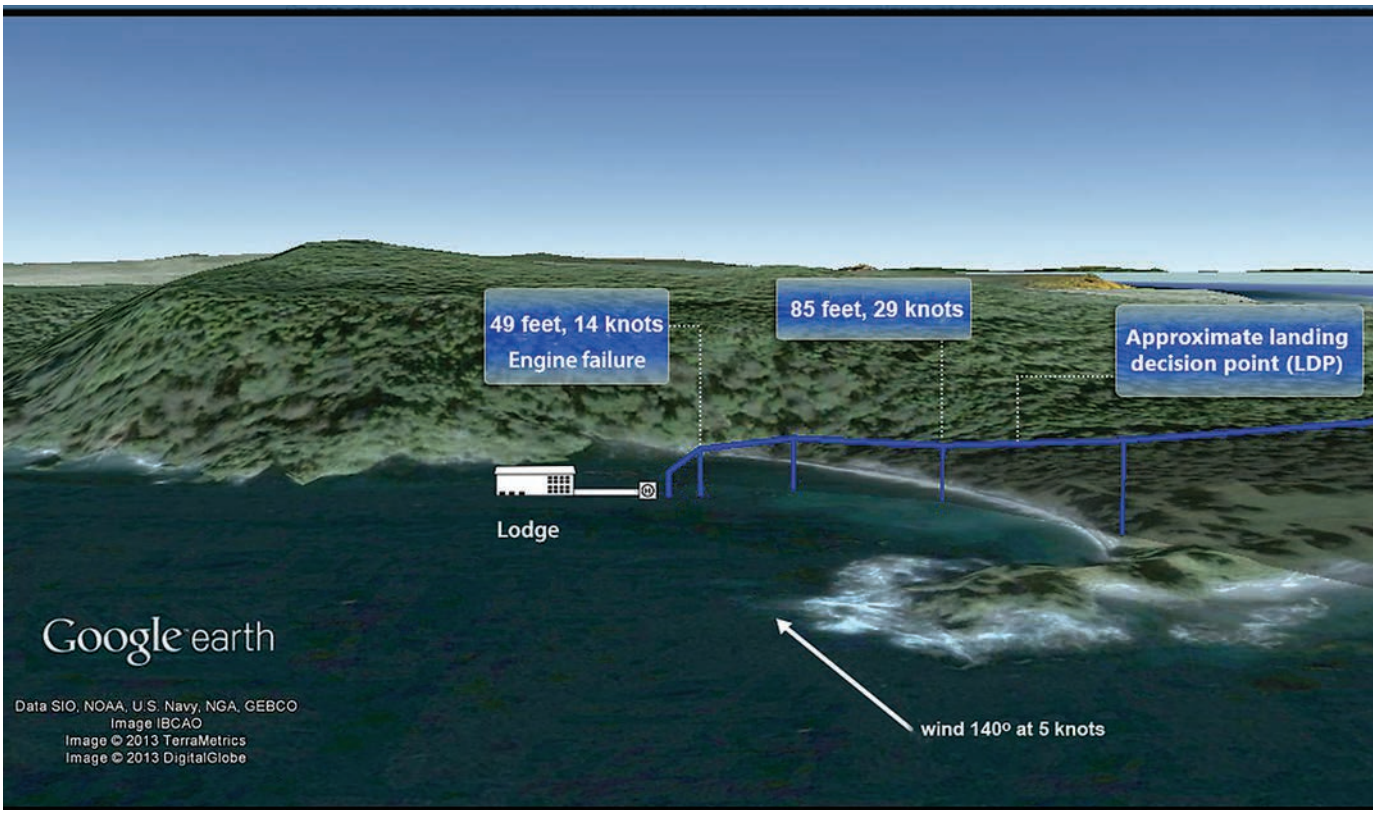


Photo 1. Engine No. 2 combustion case damage



Final flight of the helicopter relative to the fishing lodge and floating helipad

The S-76A helicopter flight manual indicates that the S-76A helicopter may be operated under Category A or B. In this occurrence, the helicopter was operated under Category B because Category A criteria could not be met at the intended landing site.

While the helicopter has two engines, its performance with one engine inoperative is affected by several factors, primarily weight. At higher gross weights, with one engine inoperative, the helicopter cannot hover or land without forward motion (run-on landing). In some cases, it uses more than 1,000 feet of landing surface distance before stopping. Considerations for performance loss, when operating with only one engine, are found in many twin-engine aircraft manuals.

The landing decision point (LDP) for the S-76A is 100 feet above the touchdown elevation at 50 knots indicated airspeed (KIAS), and at a rate of descent no more than 750 feet per minute (fpm). During Category B operations, with an engine failure before or at the LDP, the pilot may perform a balked landing go-around. With an engine failure after the LDP, a forced landing or ditching must be performed.

Operators recognize critical flight envelopes where aborted approaches or normal landings are impossible. To mitigate the risk in these flight envelopes, pilots are trained to conduct a balked approach on one engine (fly away) or, if this is not possible and the aircraft is properly equipped, to carry out an emergency landing at sites not normally considered acceptable. In this case, the helicopter was equipped with an emergency flotation system to mitigate the risk of over-water approaches to small floating helipads.

The emergency flotation system consists of two pop-out-type floats folded in compartments near the nose landing gear and two floats for the aft/main landing gear, one in each gear door. Four 3,000-pounds-per-square-inch (psi) helium- or nitrogen-charged bottles provide inflation gas; two supply the nose floats and two supply the main floats.

There are lines interconnecting each pair of bottles and floats. Should one of the inflation bottles fail to activate, the other bottle in the pair can inflate a cell in both associated floats. To inflate the flotation system, there is an electrical switch on the pilot's cyclic control stick grip.

Topographic Factors

There are defined exceptions, but generally, most places in Canada can be designated an aerodrome for the purposes of landing a helicopter. Since helicopters can land in a wide variety of areas other than certified or registered aerodromes, it is incumbent upon operators to assess the performance limitations of their helicopters in relation to the hazards present in any given landing area.

Helijet International Inc. was carrying out a non-scheduled commercial service to several remote sites, including the fishing lodge. The company was not required by regulation to register the aerodromes located at the fishing lodges. The requirements for certification do not apply to these facilities. However, the company made approach and site information charts for the benefit of its pilots. The company reviewed the hazards associated with the operation of its helicopters at

fishing lodges where runways are not available. This review prompted several upgrades to the landing sites. Most of the fishing lodges served by helicopters have floating helipads with nearby docks to access the lodging facilities. The company standardized the helipad dimensions and generally increased their size to 40 feet by 40 feet.

The topography around the helipad at the occurrence site limits the options for unobstructed missed approaches or balked landings. The 40-by-40 foot helipad was too small to allow any landing roll.

Technical examinations: Engine

A preliminary examination of the engine during retrieval from the water revealed that the No. 2 engine (starboard) had experienced a catastrophic failure of the outer combustion case (OCC). OCCs of Rolls-Royce 250 series engines are on-condition parts with no service life limit and are not required to be tracked by the total number of flight hours or cycles. The occurrence helicopter engine was fitted with the original OCC.

In 1984, the engine manufacturer issued a Commercial Engine Bulletin (CEB) providing inspection details and reinforcement patch procedures for OCCs of 250-series engines. In 1986, the Federal Aviation Administration (FAA) issued an Airworthiness Directive mandating that a reinforcement patch be installed on the armpit area of the OCC diffuser scroll elbow. The occurrence OCC had been in compliance with the AD.

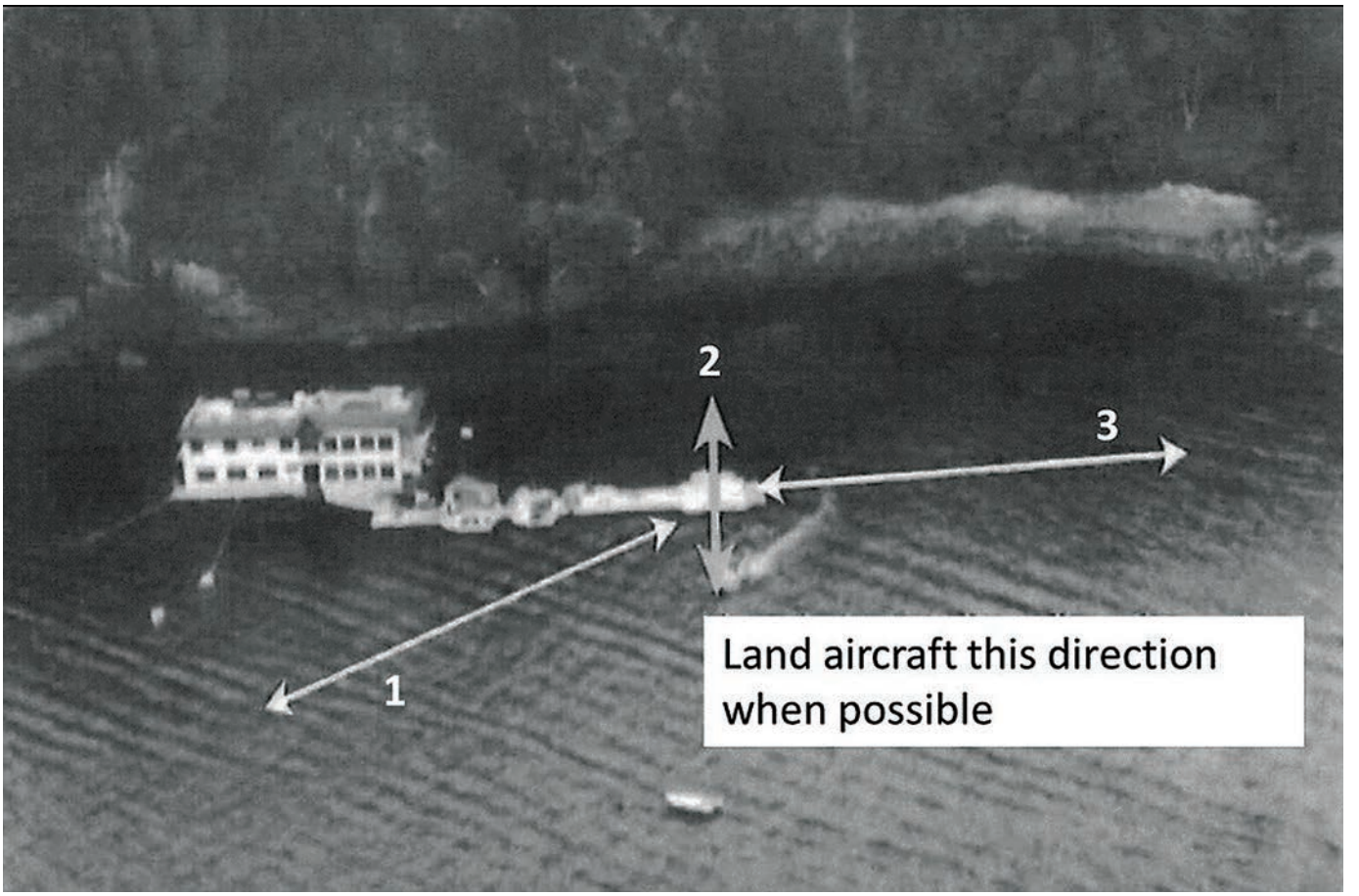
The engine was initially disassembled at Standard Aero in Richmond, British Columbia, under the supervision of the Transportation Safety Board of Canada (TSB); there were no other remarkable damage signatures. The OCC was sent to the TSB Laboratory in Ottawa, Ontario, where a more in-depth examination found that the OCC had undergone repairs (replacement of wire mesh patches) in the armpit areas. The rupture of the OCC occurred in the left-side armpit; it was the result of an overstress extension of a pre-existing fatigue crack when this crack had grown to a critical length. The main fatigue crack was formed by merging small cracks initiating from numerous separate points along the inside and outside surfaces of the horizontal butt weld and surrounding areas.

Two other small cracks were observed in the left-side armpit. One fatigue crack was located at the circumferential seam weld under the gas producer attachment flange. This crack eventually merged with the main fatigue crack via an overstress crack. The other crack was parallel to the main crack on the other side of the horizontal butt weld.

Two short cracks were also found in the right-side armpit region.

The fatigue cracking was driven by pressure cycles (engine start-stop cycles) in the OCC as part of normal engine operation. The fatigue cracks were located under the reinforcing wire mesh patches, which made the cracks difficult to detect at the initial formation stage.

At the main fatigue crack location, the OCC skin was thinner than elsewhere, and its thickness was below the



Company approach chart for the fishing lodge

minimum specified value for the skin wall thickness. It is likely that the thin areas facilitated fatigue cracking.

Technical examinations: Emergency flotation system

The emergency flotation system allows for a safe emergency ditching on water. This was accomplished, and the occupants had enough time to evacuate safely. However, the starboard floats (nose and main) subsequently deflated. The floats were examined by TSB Laboratory personnel who found that the bulkhead in the starboard nose float had split open along the entire length of the longitudinal seam, as well as across partial lengths of the circumferential seams. Since the starboard nose float was over 30 years old, the possibility exists that the glue degradation was age-related. Sikorsky does not assign a service life to these inflatable vessels and floats manufactured by the Air Cruisers division of Zodiac Aerospace. The float's manufacturer estimates that the life could be between 10 and 25 years of service. The expected life would vary greatly depending on weathering and handling issues.

Maintenance: Engine

During the investigation, the company performed one-time inspections of its fleet to assess the condition of its helicopters equipped with Rolls Royce 250-series engines. The company performed unscheduled Leak-Tek inspections on these helicopters and a total of six engines were found to have cracked OCCs, with a mean time between failures (since last 2,000-hour inspection) of about 1,000 hours. The operator replaced all defective OCCs and returned the helicopters to service. It also instituted a mandatory inspection of OCCs using the Leak-Tek method every 150 hours for the S-76A model helicopters, and found one more cracked OCC in a Sikorsky S-76A.

Maintenance: Floats

The Sikorsky S-76 maintenance instructions for checking the floats require that a visual check without the aid of special optical devices, unless otherwise found necessary, be performed on the float fabric and seams to check for cuts, tears, punctures, and abrasions. The integrity of the floats' individual cells is also checked across the transverse bulkhead with a static test. The test is completed by inflating the cells with air pressure at 3.50 pounds per square inch gauge (psig) and monitoring for 30 minutes to one hour. The pressure in the inflated cells must remain greater than 3.0 psig. If the pressure falls below 3.0 psig, maintainers are advised to return the float to the manufacturer for repair.

The starboard nose float was last inspected in May 2012 and deemed serviceable.

Sikorsky S-76

Transportation Safety Board Laboratory reports

TSB Laboratory analysis focused on the loss of power event, subsequent ditching, and the post-ditching deflation of the starboard emergency flotation system. The TSB concluded that the engine outer combustion case failed in flight because cracks propagated without being detected. This resulted in a sudden loss of pressurized air and an engine flame-out. The No. 2 engine lost power after the landing decision point; therefore a single engine overshoot could not be performed.

The pilot continued the approach for landing under limited power (one engine inoperative). The landing pad at the lodge was close, but the pilot determined it was too small to allow for a run-on landing. The pilot therefore performed a controlled ditching.

The cracks in the OCC likely started because thin metal was exposed to pressure and heat cycles. With limited inspection standards and no life limits, there is an ongoing risk of OCC failures.

The flotation system functioned and deployed; however, it did not keep the helicopter afloat in an upright position after rotor shutdown because the starboard nose float cell failed. This failure was due to aged bonding that was not strong enough to maintain a seal. A single seam failure across the transverse bulkhead caused all the cells in the float to deflate. The tear in the starboard nose float may have been the result of contact with objects in the water after the ditching. This tear may have contributed to the deflation of the forward nose float cell. The manufacturer-recommended inspections of the emergency flotation system did not provide an adequate means of assessing the condition and integrity of the floats to assure the buoyancy of the helicopter when deployed. Since there is no life limit assigned to the emergency flotation system floats, it is likely that the degradation of the bonded seams over time was not considered. With limited inspection standards and no life limits for the floats, there is an ongoing risk of float failures.

In short, the No. 2 engine outer combustion case failed due to a fatigue crack that was not detected using the recommended inspection method and intervals. The in-flight failure of the outer combustion case resulted in a power loss after the landing decision point.

A single-engine landing on the helipad was not possible, and the pilot conducted a controlled ditching with the floats deployed. After a successful ditching and evacuation, the flotation system did not keep the helicopter upright because the starboard nose float cells deflated. The subsequent imbalance in flotation caused the helicopter to roll inverted about four minutes later.

Subsequently Helijet instituted more frequent and enhanced engine inspections and replaced all of the emergency floats that were more than 14 years old. ■

Aviation Services

Aviation Services

Aviation Services

BY SAM LONGO, AME A&P

Shifting Priorities

Shift work can be brutal on normal routines, family life, and even your health.

Part of the reality of working for the airlines is a life of never-ending shift work. Despite its inherent lifestyle challenges it does have its own unique silver linings. The one aspect of being an Aircraft Maintenance Engineer that they never discussed at Centennial College, when I was a student, was the very likely possibility of working shifts. Assuming of course that your goal was to make good money, working for the airlines was the ticket to success. Although not everybody's cup of tea, as a young AME, working for Air Canada was where I wanted to be.

When Air Canada hired me in 1978 I had already been exposed to the shiftwork lifestyle. I had worked rotating shifts at Nordair in Montreal and steady midnights in Frobisher Bay. Even at DE Havilland, we had worked some stretches of steady evening shifts when production was really booming. I seemed to adapt well to these scenarios while in my early 20s, and even enjoyed the freedom to do things during the day while most people worked.

My first seven years at Air Canada was in line maintenance and this meant 24-hour coverage 365 days of the year. We worked a 6-3 shift: six midnights, six evenings, six days in never-ending rotation. The days were relatively quiet with few aircraft in the hangar, once the morning rush was done getting the last straggling aircraft to their terminal gates. Evening shift was a combination of finishing dayshift's projects and towing lots of aircraft from the terminal to the hangar, filling it for the midnight shift.

Midnight shift was the killer! We would arrive around 11:30 to a full hangar, jammed full of broken aircraft, and the race would be on. The ultimate goal was to have them all serviceable and on their gates by end of shift.

Despite enjoying the challenge of the work, by about 3AM my energy would be at its low ebb, and all I wanted was to sleep. Despite getting many hours of sleep during the day, my body just did not adapt well. It always amazed me how some fellow workers seemed to adjust to this lifestyle so easily while I always struggled to stay awake and carry on.

After seven years, and now in my early 30s, I began truly dreading when the midnight shift was imminent. Priorities were also shifting, I was in a relationship, and longed for a more normal routine. I remember scowling at people that complained of working 9-to-5. At the time, I would have given anything just to work those delightfully humane hours. Something had to be done so I made a change.

With rather low seniority, I bid on a steady evening shift with weekends off in check crew. I really hated leaving line maintenance for the more mundane routine checks on mostly wide body aircraft, but it was my only option to leave midnight shift behind. Unfortunately this created an additional problem. Now as junior man, seniority wise, I was always under threat of being bumped back to line maintenance.

My rather unsavoury solution was to volunteer to be a "tank sealer". Each crew had one man that received special training to do all in-fuel-tank repairs. Because it was a job that no one in their right mind would volunteer for, the company gave additional incentive to sign up. Besides an additional token pay increase, for one-year increments you were "unbump-able" regardless of seniority. For the next three years, I happily spent every night sleeping in my own bed and unfortunately spent many evenings wriggling around inside smelly aircraft fuel tanks. It was a high price to pay to be done with the midnight shift!

Once again, priorities were shifting. Soon after my son was born, I was fortunate to land a part time teaching contract at Centennial College in the Aircraft Department. It was beneficial in two distinct ways. Firstly it added much needed additional income to the family's bank balance and secondly it gave me a chance to try out my new chosen profession, while still working for the airline. For two years, I taught at Centennial in the mornings and worked at Air Canada in the evenings. Working steady evenings allowed me this unique "silver lining" opportunity. Although it resulted in some very long days, it also made the transition from technician to teacher much easier, with far less trepidation.

Looking back on my career now, it seems as if it all unfolded as it should, and I don't regret a single decision. In all I probably spent about 15 years working various forms of shift work and I only really seem to remember the midnight shift with real disdain. Every once in a while I think of those past days (and nights!) and thank my lucky stars for my current retired lifestyle. For everyone out there in the working world struggling with rotating shifts, I feel your pain. Trust me when I say, there is light at the end of the midnight shift. Hang in there! *For more published writing by Sam Longo, please visit www.samlongo.com* ■

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